

TABLE 1

	First exemplary embodiment	Second exemplary embodiment	Third exemplary embodiment
f	392.000	490.000	588.000
fG1p	383.774	428.158	491.657
fG2	193.834	178.506	193.291
fG1n	-114.292	-114.968	-120.369
BF	31.015	33.390	33.207
LD	360.029	412.085	476.081
D12	111.800	144.071	163.622
IH	21.640	21.640	21.640
$\theta gFG1n$	0.5883	0.5883	0.5883
$\theta gFG2$	0.5334	0.5334	0.5334
(1) BF/fG1p	0.081	0.078	0.068
(2) fGp1/fG1n	3.358	3.724	4.085
(3) vdG1n	33.27	33.27	33.27
(4) $\Delta\theta gFG1n$	-0.0019	-0.0019	-0.0019
(5) D12/LD	0.311	0.350	0.344
(6) fG1p/fG2	1.980	2.399	2.544
(7) vdG2	95.10	95.10	95.10
(8) $\Delta\theta gFG2$	0.0162	0.0162	0.0162
(9) BF/IH	1.433	1.543	1.535
(10) BF/fG2	0.160	0.187	0.172
(11) fGkp/fGkn	1.618	1.412	1.085

[Imaging Apparatus]

[0069] Next, with reference to FIG. 7, a description is given of a digital still camera (an imaging apparatus) in which the optical system according to each of the above exemplary embodiments is used as an imaging optical system. FIG. 7 illustrates a camera main body 10 and an imaging optical system 11, which includes the optical system according to any of the first to third exemplary embodiments. A solid-state image sensor (photoelectric conversion element) 12, such as a CCD sensor or a CMOS sensor, is built into the camera main body 10 and receives light of an object image formed by the imaging optical system 11.

[0070] As described above, the optical system according to each exemplary embodiment is applied to an imaging apparatus such as a digital still camera, whereby it is possible to obtain an imaging apparatus which is light and in which aberration such as chromatic aberration is excellently corrected.

[0071] While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

[0072] This application claims the benefit of Japanese Patent Application No. 2017-223150, filed Nov. 20, 2017, which is hereby incorporated by reference herein in its entirety.

What is claimed is:

1. An optical system comprising:

a first lens unit having a positive refractive power;
a second lens unit; and

a third lens unit disposed in order from an object side to an image side, the second lens unit configured to move in focusing so that an interval between adjacent lens units among the first, second, and third lens units changes,

wherein the first lens unit includes a positive lens G1p disposed closest to the object side and a negative lens G1n being a closest negative lens with respect to the object side, and

wherein the following conditional expressions are satisfied:

$$0.02 < BF/fG1p < 0.14$$

$$2.00 < |fG1p/fG1n| < 10.00$$

$$20.0 < vdG1n < 40.0$$

$$-0.1000 < \theta gFG1n - (-1.665 \times 10^{-7} \times vdG1n^3 + 5.213 \times 10^{-5} \times vdG1n^2 - 5.656 \times 10^{-3} \times vdG1n + 0.7268) < -0.0010$$

where BF is a back focus of the optical system, fG1p is a focal length of the positive lens G1p, fG1n is a focal length of the negative lens G1n, vdG1n is an Abbe number of a material of the negative lens G1n, and $\theta gFG1n$ is a partial dispersion ratio of the negative lens G1n.

2. The optical system according to claim 1,

wherein the first lens unit includes a lens G2 disposed adjacent to the positive lens G1p at the image side, and

wherein the following conditional expression is satisfied:

$$0.13 < D12/LD < 0.50$$

where D12 is a distance on an optical axis between the positive lens G1p and the lens G2 and LD is a distance on the optical axis from a lens surface furthest on the object side of the first lens unit to an image plane.

3. The optical system according to claim 2, wherein the lens G2 has positive refractive power.

4. The optical system according to claim 3, wherein the following conditional expression is satisfied:

$$0.05 < BF/fG2 < 0.23$$

where fG2 is a focal length of the lens G2.

5. The optical system according to claim 3, wherein the following conditional expression is satisfied:

$$1.5 < fG1p/fG2 < 5.0$$

where fG2 is a focal length of the lens G2.

6. The optical system according to claim 3, wherein the following conditional expression is satisfied:

$$vdG2 > 73.0$$

Where vdG2 is an Abbe number of a material of the lens G2.

7. The optical system according to claim 3, wherein the following conditional expression is satisfied:

$$0.0100 < \theta gFG2 - (-1.665 \times 10^{-7} \times vdG2^3 + 5.213 \times 10^{-5} \times vdG2^2 - 5.656 \times 10^{-3} \times vdG2 + 0.7268) < 0.1000$$

Where vdG2 is an Abbe number of a material of the lens G2 and $\theta gFG2$ is a partial dispersion ratio of the lens G2.

8. The optical system according to claim 1, wherein the second lens unit has a negative refractive power and moves to the image side in focusing from infinity to a close distance.

9. The optical system according to claim 8, wherein the second lens unit consists of a single negative lens.

10. The optical system according to claim 1, wherein the first lens unit is immovable in focusing.